

## WHAT IS CLAIMED IS:

1. A microbubble composition for binding to a target, comprising:  
gas-filled microbubbles in a liquid carrier;  
5 said microbubbles substantially having crenated microbubble membranes; and  
said membranes including binding targeting molecules that bind to the target.
2. The microbubble composition of claim 1, wherein the microbubble  
membranes comprise a lipid, protein, polymer or other surfactant, or a combination  
10 thereof.
3. The microbubble composition of claim 1, wherein the gas is  
substantially insoluble in blood.
- 15 4. The microbubble composition of claim 3, wherein the gas is a  
fluorine-containing gas.
5. The microbubble composition of claim 1, wherein the microbubbles  
have a mean diameter of about 1 to about 10 micrometers.  
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6. The microbubble composition of claim 1, wherein the target is a  
receptor, and wherein the binding targeting molecules bind to the receptor.
7. The microbubble composition of claim 6, wherein the receptor is  
25 selected from the group consisting of extracellular matrix proteins, adhesion  
molecules, G-protein coupled receptors, cell surface proteins, cytokines,  
glycoproteins, peptides, lipids, glycolipids, carbohydrates or combinations thereof.
8. The microbubble composition of claim 1, wherein the targeting  
30 molecules are selected from the group consisting of peptides, peptide mimetics,

aptamers, proteins, antibodies and antibody fragments, oligosaccharides, and small organic molecules.

9. A microbubble composition useful for binding to a target,  
5 comprising:

a suspension of gas-filled microbubbles in a liquid carrier, said microbubbles substantially having microbubble membranes having surface projections, said membranes further including binding targeting molecules that bind to the target.

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10. The microbubble composition according to claim 9, wherein said surface projections comprise membrane folds.

11. The microbubble composition of claim 9, wherein the membranes  
15 comprise a lipid, protein or surfactant, and wherein the microbubbles have a mean diameter of about 1 to about 10 micrometers.

12. The microbubble composition of claim 9, wherein the gas is substantially insoluble in blood.

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13. The microbubble composition of claim 12, wherein the target is a cell membrane bound receptor, and wherein the targeting molecules bind to the receptor.

25 14. The microbubble composition of claim 9, wherein the targeting molecules are selected from the group consisting of peptides, peptide mimetics, aptamers, proteins, antibodies and antibody fragments, oligosaccharides, and small organic molecules.

30 15. The microbubble composition of claim 13, wherein the receptor is selected from the group consisting of extracellular matrix proteins, adhesion

molecules, G-protein coupled receptors, cell surface proteins, cytokines, glycoproteins, peptides, lipids, glycolipids, carbohydrates or combinations thereof.

16. A microbubble composition useful for binding to a target,  
5 comprising:  
a suspension of microbubbles in a liquid carrier, said microbubbles predominantly having non-spherical microbubble membranes, said non-spherical microbubble membranes exhibiting increased deformability under shear relative to corresponding spherical microbubble membranes, and said microbubble  
10 membranes comprising a binding targeting molecule for binding to the target.

17. The microbubble composition of claim 16, wherein the membranes comprise a lipid, protein, polymer or other surfactant, or a combination thereof.

18. The microbubble composition of claim 16, wherein said gas is  
15 substantially insoluble in blood.

19. The microbubble composition of claim 16, wherein the  
20 microbubbles have a mean diameter of about 1 to about 10 micrometers.

21. The microbubble composition of claim 16, wherein the target is a  
cell membrane bound receptor, and wherein the targeting molecules bind to the  
receptor.

22. A method for binding microbubbles to a target, comprising:  
25 contacting the target with a microbubble composition according to any of  
claims 1, 9 and 16.

23. A method according to claim 22, wherein microbubble membranes  
30 of the microbubble composition include a targeting molecule attached by a spacer  
arm.

24. A method for preparing a targeted microbubble composition,  
comprising:

forming gas-filled microbubbles having spherical microbubble membranes  
5 suspended in a liquid carrier;

converting the spherical microbubble membranes to non-spherical  
microbubble membranes; and

attaching to or incorporating into said microbubble membranes targeting  
molecules for binding to a target.

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25. The method of claim 24, wherein said targeting molecules are  
attached to or incorporated into the membranes prior to said converting.

26. The method of claim 24, wherein said targeting molecules are  
15 attached to or incorporated into the membranes after said converting.

27. The method of claim 24, wherein said converting includes causing a  
partial release of gas from within the spherical microbubble membranes.

28. The method of claim 27, wherein said converting includes  
20 subjecting the spherical microbubble membranes to pressure.

29. The method of claim 38, wherein said pressure is applied by  
hydrostatic pressure, ultrasonic waves, or an osmotic pressure gradient across the  
25 microbubble membrane.

30. The method of claim 24, wherein the targeting molecules are  
selected from the group consisting of peptides, peptide mimetics, aptamers,  
proteins, antibodies and antibody fragments, oligosaccharides, and small organic  
30 molecules.

31. A pharmaceutical composition, comprising a microbubble composition according to any of claims 1, 9 and 16, wherein the liquid carrier is a pharmaceutically acceptable liquid carrier.

5           32. A pharmaceutical composition according to claim 31, which is a therapeutic composition.

33. A pharmaceutical composition according to claim 31, which is a diagnostic composition.

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34. A pharmaceutical composition according to claim 33, which is an ultrasound contrast agent.

35. A method for ultrasound imaging in a patient, comprising:  
15           introducing into the patient an ultrasound contrast agent according to claim 34; and  
             developing an ultrasound image based upon said composition.

36. A method for therapeutic treatment of a patient, comprising  
20           administering to the patient a therapeutic composition according to claim 32.